Province of
British Columbia

GUIDELINES

AN UPDATE ON

Chimneys, Air-tight Stoves Fireplace Inserts and Glass Doors

PUBLISHED BY THE OFFICE OF THE FIRE COMMISSIONER, MINISTRY OF ATTORNEY GENERAL,
SUITE 1, 2780 EAST BROADWAY, VANCOUVER, BRITISH COLUMBIA V5M 1Y8 TELEPHONE: 251-3131

No. 80-4
A supplement to guidelines No. 79-4

Contents

	Page
Introduction	1
What Kind of Chimney is Best?	2
Inspection and Maintenance of Factory-built Class "A" Chimneys	2
Inspection and Maintenance of Masonry Chimneys	4
Selecting a Stove	5
Further Safety Tips When Installing or Operating an Air-tight Stove	6
Fireplace Inserts	6
Fireplace Insert Installations	8
Glass Doors	8

LEGISLATIVE LIBRARY OF ONTARIO
TORONTO
WITHDRAWN
MAR 09 1981
RECEIVED

Introduction

In the last year, several problems with regards to the Class "A" and masonry chimneys came to light. The severity of the creosote problem was underlined and the rapid influx of a variety of fireplace inserts caused considerable concern, and it was felt that an update of the information would be appropriate until the next revised edition of the guidelines 79-4, "Safe Installation & Use of Solid-fuel Burning Appliances".

Also in the last year or so, manufacturers, distributors, and retailers of solid-fuel burning appliances and chimneys have got together and began to project themselves as a unified professional group. The recent formation of the British Columbia Chapter of the Canadian Wood Energy Institute (CWEI), the first chapter in Canada, is but one clear indication of their goal toward professionalism. What this means to the individual who wishes to burn wood for heating is that member dealers will be better informed in the safe installation and use of solid-fuel burning equipment.

WHAT KIND OF CHIMNEY IS BEST?

There is no obvious answer, if any at all, to that question. Masonry chimneys have been the standard for a long time. But they came to be the standard by default—they were the only competitors in the field. This, of course, does not imply they are as safe as they should be. Masonry chimneys as usually built may not have enough clearance to combustibles during abnormal high-temperature continuous operation. But short-duration temperature surges are absorbed by the mass of the masonry with little effect on exterior temperatures. However, masonry chimneys can also crack during chimney fires and their creosote accumulation rate is relatively high.

As with masonry chimneys, all listed factory-built chimneys seem to handle normal use relatively safely. But chimney fires can apparently cause dangerously high temperatures on nearby combustibles. Insulated factory-built chimneys do not seem to accumulate as much creosote as other types; thus chimney fires may be less frequent and less severe. But chimney fires can damage this type of chimney. Factory-built, air-insulation or air-cooled (thermosyphon) chimneys appear not to be as susceptible to damage during chimney fires. But they also seem to accumulate more creosote than the insulated chimneys; this seems to be particularly true of the air-cooled type.

Obviously more research is needed. Meantime, it is clear that all code-approved chimneys—metal and masonry—are reasonably safe during normal use and that no standard residential chimney is absolutely safe during a chimney fire, and that all chimney fires are avoidable through proper operation and maintenance.

INSPECTION AND MAINTENANCE OF FACTORY-BUILT CLASS "A" CHIMNEYS

Chimneys must be inspected and cleaned regularly. Where a chimney is enclosed in a chase, it becomes necessary to install inspection openings. These openings must be adequately sized to enable a thorough examination from floor to ceiling.

Outlined below are some pointers regarding factory built Class "A" metal chimneys; some are "problems" which have already been remedied by the manufacturers, and others are a matter of further education for users.

The "problems" are outlined here so that the user may recognize them if he comes across any in his own installation.

(1) In many chimney sections, voids were discovered in the insulation between the inner and outer metal casings. This lack of insulation resulted in high temperatures on the outer casing. While the temperature reached may not by itself be sufficient to ignite combustibles 2 inches away (which is the required clearance for many of these chimneys), the temperatures would be sufficient to pyrolize the combustible over a period of time and eventually ignite it at a temperature much lower than its normal ignition temperature.

ULC and the manufacturers have tackled this problem, but there may be some existing installed chimney sections that you may come across. Look out for tell-tale heat marks as shown in Photo 1. Such sections must be replaced. If in any doubt, see your local dealer.

Photo 1: Heat marks are good indicators of voids in the insulation.

(2) Corrosion: The inside liner of a Class "A" metal chimney is of stainless steel and outer casing may be stainless steel or galvanized steel. The test standard has a condensing sulphur dioxide test that is carried out on the chimney section to test for corrosion resistance. However, experience indicates that corrosion in some existing chimney sections may be quite prevalent.

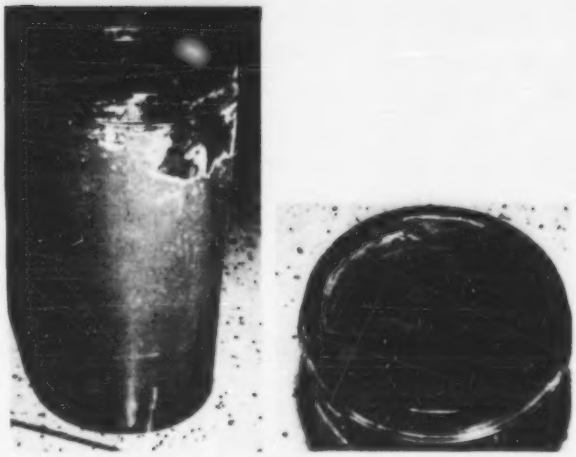

Photo 2: Corrosion on outer and inner stainless steel linings of factory-built chimneys.

Manufacturers have now improved their designs to prevent corrosion. If corrosion is found on existing installations, the manufacturers have agreed to replace, at a very nominal or no charge, the corroded sections with new sections.

Photo 3: Inner steel lining separated from the rest of chimney section.

(3) There have been several reports of mechanical failures in these factory-built chimneys. One complaint, heard a few times, is that the inside liner simply separates from the rest of the chimney, especially during the chimney cleaning process (see Photo 3). When that happens the chimney has failed, the insulation may fall out, leaving only the outer shell of the chimney to protect any adjacent combustibles from such high temperatures. Manufacturers state that they have changed their designs and that this problem has been rectified. That does not rule out the possibility of further similar reports arising from existing installations. Homeowners should watch for such problems. Some manufacturers have agreed to replace these chimney sections at nominal or no cost.

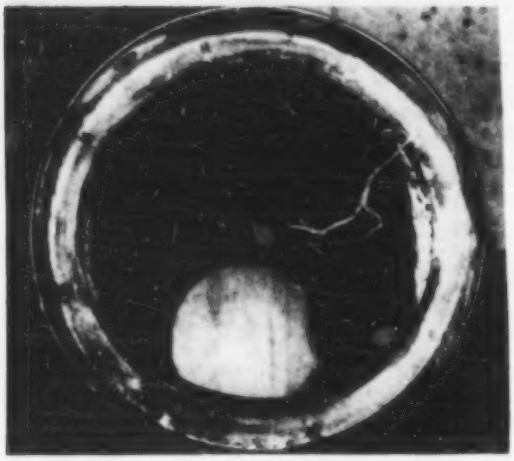

Photo 4: During a severe chimney fire the inner lining may warp, the seam could separate and sometimes the whole inner lining may be dislodged.

(4) The chimney must be kept clear of excessive creosote and soot deposits. One of the existing test criteria of these chimneys is a 10-minute test in which flue gases of 1,700° F. are vented through the chimney. This is supposed to simulate a soot burnout or a creosote fire. This is now recognized to be inadequate for a very severe chimney fire. Tests carried out in various laboratories indicate conclusively that creosote fires produced temperatures as high as 2,130° F. and for periods extending to as long as 1 hour and 16 minutes.

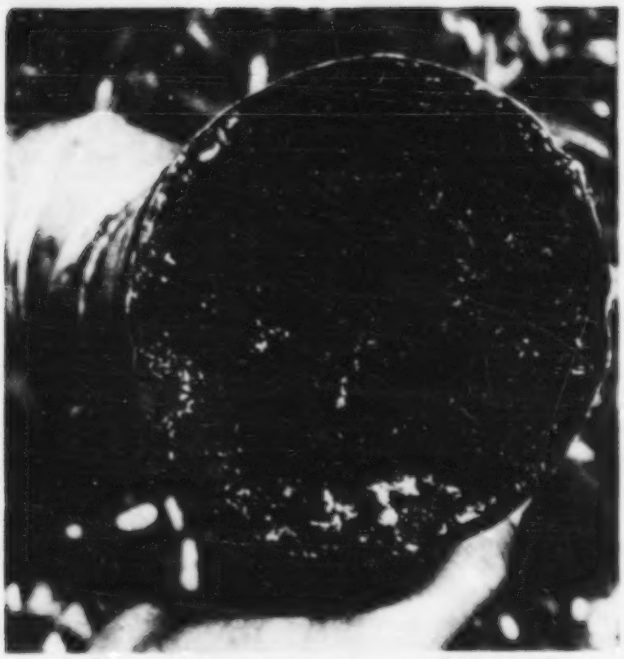

Photo 5. Under severe conditions, creosote accumulation can totally block the chimney or smoke-pipe, if not cleaned regularly.

Standards are now being developed for a higher grade insulated metal chimney. But emphasis must still be laid on frequent cleaning of the chimney to minimize creosote build-up in the first place, thereby reducing the chance of a chimney fire.

(5) Prefabricated metal chimneys must be installed according to the manufacturer's instructions. Insulated chimneys are not cool on the outside; most prefabricated chimneys require a minimum of 2 inches clearance to any combustible material. All other details of the instructions must also be followed carefully, otherwise the listing may be meaningless since a testing laboratory only tests the chimney installed as specified in the instructions. Mixing pieces and components from different manufacturers does not usually work mechanically since they are not usually compatible, and even with an apparently good fit, the results may not be safe.

INSPECTION AND MAINTENANCE OF MASONRY CHIMNEYS

It is suggested that you clean a masonry chimney before inspecting it because while cleaning you may discover mechanical weaknesses such as loose bricks, soft mortar, cracked liners, or unused breachings which might not be detected in a strictly visual examination.

Examine the exterior of the chimney over its entire length if possible, and this includes in the basement and attic where applicable, and above the roof.

The chimney interior should be examined in as many locations as possible. Most chimneys have at least three holes into them—a cleanout door near the base, a "breaching" where an appliance was or is connected, and the top of the chimney. Use a hand-held or stick-mounted small mirror to look up or down a chimney interior, and a light bulb on a long cord for checking down into a chimney from its top.

In examining the chimney inside and out check for:

(1) BLACK OR DARK BROWN STAINS OR DRIPS on the chimney's exterior. These are either creosote or evidence of rain water having gotten into the chimney and then leaked out. In either case the chimney has, or at least once had defects.

(2) SOFT MORTAR: If mortar has begun to fall out from between the bricks, openings may be expected to develop all the way through the wall. If an ice pick or other sharp instrument can be pushed all the way through, rebuilding is indicated. Chimney tops are the most likely portions to require rebuilding. When this is necessary, the chimney should be torn down to the point where full solid mortar joints are found.

(3) LOOSE, MISSING, OR CRACKED MASONRY UNITS: If you are confident that these defects are only in the chimney above the roof, rebuilding of the deteriorated section may be worthwhile. However, if these defects are evident throughout the entire height of the chimney, a total rebuilding is required.

(4) AN INTACT LINER: It is recommended that masonry chimneys have fireclay liners. They help to keep chimneys "smoke-tight," and to prevent overheating and cracking of the brick, block, or stone chimney wall, particularly during very hot fires or chimney fires. Lining an existing chimney is difficult but possible.

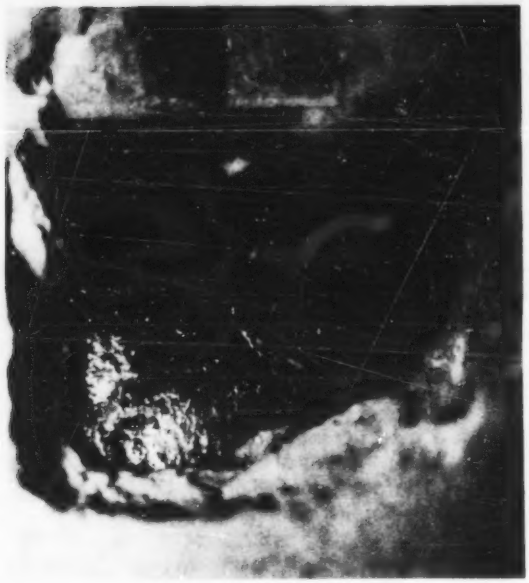

Photo 6. A broken flue liner. Also note that no mortar was used to join the two flue sections—a serious deficiency.

(5) OBSTRUCTIONS: Broken liners, fallen or loose bricks, bird nests, improperly installed chimney connectors and creosote accumulations can all cause serious blockages.

(6) UNUSED BREACHINGS: Many old chimneys apparently served to vent small stoves in every room they passed through. It is important to locate and safely seal the unused breachings. To seal an unused opening into a chimney, use masonry materials such as bricks and mortar to make the former opening as solid and tight as the rest of the chimney. The standard type of pie-plate cap is not safe because it is not securely airtight, has virtually no insulating value, and can be blown out by a pressure surge inside the chimney.

(7) CLEANOUT DOOR: Although not themselves directly related to safety, cleanout doors contribute indirectly by making it easier to clean chimneys.

(8) CLEARANCES: Masonry chimneys can get hot—hot enough for the building code to require 2 inches of clearance between combustible materials and the outside of a masonry chimney. There are three exceptions to this:

(a) Exterior chimneys require only ½-inch clearance from the combustible wall next to it.

(b) Wood or other combustible flooring must be kept at least ½-inch away from a masonry chimney.

(c) Wood trim must have at least ⅛-inch of asbestos or other noncombustible material between it and the chimney.

Many, if not most, old chimneys do not meet the clearance requirements; using them involves extra risk and requires extra precautions to avoid chimney fires and sustained very hot normal fires. In such cases, placing sheet metal, between the chimney and nearby wood gives some protection, particularly if there is a small airspace on both sides of the metal.

SELECTING A STOVE

Before selecting a wood or coal burning stove it is important that you first understand the particular problems that may be encountered during installation in relation to your own circumstances and needs. A carefully thought out wood heating "system" can go a long way toward maximizing the benefits and minimizing the hazards of wood as an alternate fuel. The following pointers may serve as a guide:

Chimney—The chimney is perhaps the most important part of the wood heating system. Consult your dealer regarding suitability for needs. If you are planning to use an already existing chimney be sure that it is in sound condition, properly built or installed and of adequate size. If you are constructing a new masonry chimney, some consideration should be given to locating it centrally, where it will be less prone to being chilled. Avoid outside masonry chimneys which tend to remain cool and thus more prone to creosote accumulation.

Placement—Is there adequate space to allow safe distances from the stove and chimney connector to combustibles such as walls, ceilings, mantles, furnishings? Is there enough floor space for the required hearth extension to allow ample room for people to move about safely? From a heating standpoint, a central location in the home will allow more even heat distribution.

Fuel—Will coal be used as a fuel? If so, buy a stove that has been designed to properly burn coal, and follow the manufacturer's instructions. COAL SHOULD NOT BE BURNED IN A DEVICE DESIGNED ONLY FOR WOOD FUEL, BUT WOOD MAY BE USED SAFELY IN A COAL-BURNER. Coal fires tend to be hotter than wood fires and thus may damage a wood-only heater. Coal heaters can usually be identified by their grates. Coal grates are usually designed to be shaken or rotated to help the clinkers fall through. Because of the higher fire temperatures, coal grates are usually more massive than wood grates. Most contemporary coal heaters have firebrick liners.

Sizing—One aspect that is often overlooked in the selection of a wood stove is the importance of matching a stove's heating capacity to the space to be heated. Going for that "extra capacity," especially in an air-tight design, usually results in the stove being operated at less than its optimum burning efficiency to avoid overheating the room space. Underfiring any stove causes incomplete combustion which will likely leave creosote deposits in the chimney system, especially on parts of the system that are relatively cool (e.g., uninsulated chimney connector), and in the elbows and tees where the flue gases tend to slow down. This problem becomes more severe during the warmer months by the lack of buoyancy of the flue gases (draft) because of the warmer outside temperatures. (See Photo 5). It is, therefore, best to choose a stove with a capacity that will allow you to operate the stove efficiently for the average heating day in the area where you live. Although a manufacturer may rate a stove capable of heating 2,000 square feet, for example, it doesn't mean it can be done efficiently in your home. Whether your house has a open plan or divided into many rooms, is well insulated or is difficult to heat, or whether the stove is for the living room or an unfinished basement, should all have a bearing on your decision. If you are planning to heat primarily with wood, you will have better control if you install two or more smaller stoves with the aim of operating them as needed as opposed to one big one. Often it is found necessary with wood heating to strike a compromise in favour of safety (control of creosote) over convenience (frequency of loading) in order to achieve a truly efficient system.

FURTHER SAFETY TIPS WHEN INSTALLING OR OPERATING AN AIR-TIGHT STOVE

(1) In some instances, manufacturers may specify installation clearances that are more than those required in the code. In any case where there is a conflict, we suggest that you adhere to the more restrictive clearances specified (i.e., the greater ones). If the stove is listed or certified by an acceptable testing laboratory, then follow the manufacturer's installation instructions.

(2) Chimney connectors (smoke pipe) should be of at least 24 gauge thickness even though the code may allow a lesser thickness. Connector joints should be tight fitting and as air-tight as possible. Snap-lock pipe should be avoided in favour of welded or fully seamed pipe.

(3) It is during the period before the wood is reduced to charcoal that the bulk of creosote forming gases are released from the wood. These gases will burn off if a relatively hot fire is maintained during the first 30 to 90 minutes after fresh wood has been added to the fire. An effective way of avoiding excessive creosote is by avoiding long periods of low fire.

(4) Installations should be inspected frequently for signs of creosote build-up. The best places to check are in the chimney connector (by rapping it with a metallic object and listening for dullness), at the chimney cap, and at the cleanout with the aid of a mirror and flashlight. As experience and knowledge of your system is gained, the inspection intervals can be lengthened.

FIREPLACE INSERTS

Due to the relative newness of this product, questions are being asked by local authorities, industry, and individuals regarding fireplace inserts and possible problems related to them. Our concerns at this time are:

1. *Radiation*
   Inserts are being installed with inadequate clearances to combustibles either because of insufficient hearth extension or proximity to structural combustibles such as mantels, panelling, etc. Some of this may be due to misleading advertising, i.e., inserts shown in fireplaces with no hearth extension. The consumer assumes that he can also install his insert as shown in the advertisement, or the consumer may not receive installation instructions. In some cases, sufficient heat can be conducted downwards, through the hearth extension, to ignite the sub-floor.

2. *Improper Cleaning*
Because the inserts are awkward and heavy, there seems to be an apathy or reluctance toward removing the insert when cleaning the chimney. As a result, the loosened creosote falls onto the smoke shelf or around the insert and is not removed. This accumulated creosote eventually ignites creating a serious chimney fire which may destroy the masonry chimney making the insert unusable.

3. *Improper Insert Venting*
Many inserts are manufactured to vent the flue gases into the fire box of the fireplace and the front opening is usually sealed with a covering plate.

   (a) Excessive heat can build-up in the firebox of a fireplace, resulting in damage of the fireplace and ignition of adjacent combustibles. In a normal open fireplace air is drawn up the chimney from the room due to the good flue draft. This air (dilution air) has a cooling effect on the flue gases in the fireplace and chimney. However, when an insert is used with the doors closed, adequate air for combustion is provided through the inlets on the front but there is no cooling effect of the dilution air. This problem has also been experienced on masonry fireplaces when glass doors were installed in the fireplace opening. The problem may not exist if the glass doors were designed to allow sufficient dilution air.

   (b) Without a flue connector to direct flue gases up into the chimney, flue gases may cool adequately within the firebox of the masonry fireplace and create a creosote problem. Another concern is that without a well fitting flue connector, creosote and soot may fall from within the chimney on and around the insert. There have been cases in which inserts have been dislodged from fireplaces when the accumulated soot and creosote ignited.

   (c) Depending upon the insert model and/or the shape of the masonry fireplace, the insert exhaust may in some cases discharge directly onto the steel lintel. When this occurs, the wood framing header behind the drywall and above the face brick may ignite. See Photo 7. There are two theories for this occurrence. Either the exhaust gases escape up behind the decorative facing brick because of the poor seal by the mortar; or heat is directly conducted through the brick. See Figure 1.

Photo 7: Concealed combustible framing behind the gyproc wall and wooden mantel (not shown) were ignited by flue gases escaping up behind the decorative facing brick.

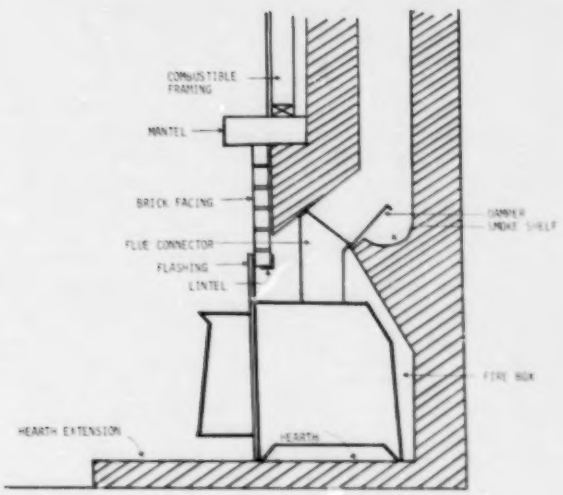

Figure 1: A well-fitted direct flue connector is recommended when installing a fireplace insert.

FIREPLACE INSERT INSTALLATION

At the time of writing, there is no published standard for fireplace inserts. However, a ULC committee has begun to draft one. There are a few models on the market that are tested and listed but they are probably tested to one or more existing standards for fireplace stoves and/or solid-fuel-fired room heaters. In the absence of a national standard, the following points must be emphasized for the installation of fireplace inserts:

(1) Obtain a permit from the local building department or Local Assistant Fire Commissioner.

(2) Ensure that your fireplace and chimney are well constructed and will be able to handle the possible higher temperatures. Go to a knowledgeable fireplace insert dealer who may provide this service. He can also advise you on the correct size of insert to get for your particular fireplace.

(3) Ensure that there are no combustibles (mantels, strapping, panelling) within 3 feet of the sides, rear and top of insert unless the insert has been listed for lesser clearances.

(4) Make sure that any space behind the facia brick is well sealed with mortar.

(5) A well fitted direct flue connector is suggested (although not mandatory) to vent the insert flue gases directly through the throat of the fireplace as shown in Figure 1. It is expected that his method will remedy some of the problems outlined in the foregoing pages.

(6) The flashings that close the opening in the fireplace must fit tightly against the facia brick. These flashings must be readily removable for frequent inspections. These inspections are a definite MUST if a flue connector is not installed. It is suggested that these inspections be carried out every 2 weeks at first until a better picture is obtained of the rate of creosote accumulation behind the flashings.
It is recognized that a direct flue connector may not be practical at this time for some inserts because of the lack of clearances between the top of the insert and the top of the fireplace firebox. In such cases ensure that the flue outlet of the insert is directly below the throat of the fireplace.

(7) Monitor the temperature of the bricks around the fireplace opening for the first several fires you use the insert. One ready method of determining that a chimney or fireplace is unsafe is to hold your hand against the bricks while it is in use. If it is too hot to comfortably hold your hand, the installation may be unsafe. This test can best be made when the chimney has been in operation for several hours in a period when the insert is being used at its maximum rate.

(8) Inserts must not be installed in any factory-built fireplaces.

(9) When the insert is removed for chimney cleaning, remember to clean the smoke shelf. This may be done in most installations by reaching up through the fireplace damper.

GLASS DOORS

There have been reports of glass doors on fireplaces shattering and throwing pieces of hot glass into the room.

The ULC committee responsible for standards in the area of fireplaces and associated equipment is currently studying the problem and probably, in the near future, requirements will be added which will enable the glass to sustain a greater degree of abuse than it can at this time. Until the new requirements come about it is advisable in some cases to use a screen in front of the glass doors for that extra factor of safety.

Users should observe the following safety tips:

(a) Inspect the glass regularly for cracks or breaks. If you detect a crack or break, allow the fire to die out and take the door to your stove dealer for glass replacement before further use.

(b) Do not slam stove doors or otherwise impact the glass. When closing doors, make sure that no logs or other objects protrude to impact against the glass.

(c) Do not clean the glass when it is hot or with materials which may scratch it (or otherwise damage the glass). Scratches on the glass can develop into cracks or breaks.

(d) Never put substances which can ignite explosively in the fireplace/stove since even small explosions in confined areas can blow out the glass.

(e) The ULC standard has provisions to cover extremes of usage but users should be very careful and not attempt to get more heat out of a unit than it was designed to produce by overfiring their unit continously. If glass doors are installed on a masonry fireplace, monitor the temperature of the facing bricks around the opening of the fireplace (see page 7). If it's too hot, provide more dilution air.

BIBLIOGRAPHY

"Wood Heat Safety" by Jay W. Shelton, Garden Way Publishing, Charlotte, Vermont 05445.

"The Woodburners Encyclopedia" by Jay W. Shelton and Andrew B. Shapiro, Vermont Crossroads Press, Waitsfield, Vermont.

Proceedings Document for Wood Heating Seminar 4 (1979), by Wood Energy Institute, Camden, Maine.

Queen's Printer for British Columbia ©
Victoria, 1980